DOCUMENT RESUME

ED 471 917 RC 023 762

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|---|---|
| AUTHOR | Howley, Craig |
| TITLE | What Is Our Work? Planning a Future Understanding of Mathematics Education in Rural Context--A Prolegomenon. Occasional Paper. |
| INSTITUTION | Ohio Univ., Athens. |
| SPONS AGENCY | National Science Foundation, Arlington, VA. |
| REPORT NO | No-1 |
| PUB DATE | 2002-10-00 |
| NOTE | 37p.; Produced by the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Paper presented at the Annual Meeting of the International Society for Educational Planning (32nd, Istanbul, Turkey, October 3, 2002). |
| CONTRACT | NSF-0119679 |
| AVAILABLE FROM | For full text: http://kant.citl.ohiou.edu/acclaim/rc/rc_sub/pub/4_occr/CBH_OP1.pdf. |
| PUB TYPE | Information Analyses (070) -- Opinion Papers (120) -- Speeches/Meeting Papers (150) |
| EDRS PRICE | EDRS Price MF01/PC02 Plus Postage. |
| DESCRIPTORS | Context Effect; Educational Attitudes; *Educational Principles; Educational Research; Elementary Secondary Education; *Mathematics Education; Place Based Education; Research Needs; Research and Development; Role of Education; *Rural Education |

ABSTRACT

A prolegomenon--a "critical discussion to introduce and interpret an extended work"--exactly describes the purpose of this essay, since the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM) is very much an extended work. This essay develops a tentative theoretical framework to help represent intended purposes, commitments, and arguments of ACCLAIM's extended work. ACCLAIM's mission is the cultivation of indigenous leadership capacity for the improvement of school mathematics in rural places. It aims to understand the rural context as it pertains to learning/teaching mathematics, and to articulate in scholarly works, including empirical research, the meaning and utility of that learning and teaching for and by rural people. Elements of the framework developed in this essay include the nature of mathematical knowledge, the view of the context of education as being as important as technical concerns of curriculum and instruction, the rural context versus cosmopolitan norms, and mathematical knowledge in rural context and vice versa. Four principles are offered for rural mathematics education research: it should describe the salient relationships between mathematical knowledge and rural context, examine rural schools as they serve or subvert the gatekeeping functions of school mathematics, examine hypotheses about the place occupied by mathematics knowledge in and for rural communities, and elaborate theories of "pedagogy of place" for mathematics education in rural schools. Appendix discusses exemplary rural mathematics programs. (Contains 62 references.) (SV)

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ED 471 917

Appalachian Collaborative Center for Learning, Assessment and Instruction in Mathematics

Occasional Paper Series

Occasional Paper No. 1

# What Is Our Work?
# Planning a Future Understanding of Mathematics Education in Rural Context---A Prolegomenon

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**Ohio University**

**October 2002**

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ACCLAIM's mission is the cultivation of *indigenous leadership capacity* for the improvement of school mathematics in rural places. The project aims to (1) understand the rural context as it pertains to learning and teaching mathematics and (2) articulate in scholarly works, including empirical research, the meaning and utility of that learning and teaching among, for, and by rural people.

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Funded by the National Science Foundation as a Center for Learning and Teaching, ACCLAIM is a partnership of the University of Tennessee (Knoxville), University of Kentucky (Lexington), Kentucky Science and Technology Corporation (Lexington). Marshall University (Huntington, WV), University of Louisville, and Ohio University (Athens, OH).

This material is based upon the work supported by the National Science Foundation Under Grant No. 0119679. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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## Précis

ACCLAIM's mission is the cultivation of *indigenous leadership capacity* for the improvement of school mathematics in rural places. The project aims to (1) understand the rural context as it pertains to learning and teaching mathematics and (2) articulate in scholarly works, including empirical research, the meaning and utility of that learning and teaching among, for, and by rural people.

What is Or Work?
Planning to a Future Understanding
of Mathematics Education in Rural Context – A Prolegomenon[1]

A "prolegomenon" is a "critical discussion serving to introduce and interpret an extended work" (*Collegiate Dictionary*). The word exactly fits the purpose of this essay, since the Appalachian Collaborative Center for Assessment, Instruction, and Learning (ACCLAIM) is very much *an extended work*. The essay that follows develops a tentative theoretical framework to help represent something of the intended purposes, commitments, and arguments of ACCLAIM's extended work. It is necessarily and intentionally incomplete, especially so, in fact, because it argues for a rural place-based perspective on mathematics education research and development.

## A Theory of Connected Works and Actions

In *The Human Condition*, the philosopher Hannah Arendt (1959), working from classical perspectives, distinguished "work" from "action." Works, in her account, were the physical products of craftsmanship: poems, furniture, useful objects, novels, and certainly, research reports. Actions, by contrast, produced no tangible and final products. According to Arendt, actions had no "outcomes." Short of the final extermination of human life, in Arendt's view, every action must lead ceaselessly to another. Action was not only endless, it consisted *mostly of speech*. Action was not (as is now so often thought, especially among people concerned with schooling) principally behavior or movement, but rather face-to-face speech (see also, Habermas, 1987, on the role of speech in action).

[1] A "prolegomenon" is an critical introduction to an extended work, and often serves in just the *prospective* sense as the present essay. This paper was presented at the 32nd annual meeting of the International Society for Educational Planning, Istanbul, Turkey, October 3, 2002.

Confounding works and actions. According to Arendt, Americans were particularly prone to confound action with work, so that action was nearly always misunderstood as leading to a *pre-defined end.* Arendt would not, apparently, have approved of the concept of "school improvement processes" that entailed predetermined results. Such a view not only misprized action, but, in her view, mistook education (a process, a continuous action) as a thing. One does not, on this view, get or receive an education, but instead undertakes an extended conversation (speech, action) about life and life's purposes. I often refer to the more conversational sort of education as "true education" in order to distinguish from the too-often phony education deployed in too many schools.

If some people cynically conclude that "school improvement" is only so much hot air, Arendt would have told us, that is because hot air (speech) is exactly the thing that constitutes action. The problem, in this light, is that action so often disappoints us. And this disappointment perhaps stems, as Arendt observed, from a misguided expectation that action will lead to a tangible product where *none can be* forthcoming. Action "produces" only more action. Americans' dashed expectations, in short, are founded on bad ontology.

Americans' view of school improvement has, however, somewhat changed in recent years, so that it perhaps accommodates better Arendt's famed distinction. At least in abstract rhetoric (if seldom in practice), improvement is now very commonly projected as ceaseless ("continuous"), and Arendt would have affirmed this contemporary view of improvement as more ontologically correct and useful than schemes in which goals and objectives predefine a future state of "improvement" that can be readily distinguished from an *unimproved* state.

School improvement today more often means that people are talking and thinking about what schools do (how they act in them)—all in the hope (if not in exact expectation) that *actions*

will become better and wiser.[2] From the vantage of an Arendtian view of action, one *ought* to ask such improvement of oneself or ones organization, but one should not delude oneself into thinking that an ardently desired result is inevitable or even likely, since the continuity and indeterminacy of action implies, and perhaps necessarily entails, future reversals. One need only look to history—as Arendt often did—to gauge the aptness of this insight. To be sure, Arendt took the long view, and that is what makes her perspective valuable: school improvement action is often—far too often—short-sighted.[3]

Indeed, one may hope that ACCLAIM's actions resonate meaningfully for a long time, and that hope seems in some way to capture the mission of "capacity building" ascribed to all the Centers for Learning and Teaching by the National Science Foundation. But on such a view as Hannah Arendt's, one would not predict the *outcomes* of *actions* undertaken by ACCLAIM.

There is a realm, nonetheless, in which outcomes can be anticipated. The *works* that eventuate from the project—doctoral dissertations, working papers, monographs, essays, occasional papers, and other publications. All these are somewhat more subject to the delimitations of a "prolegomenon." More particularly, as a university-centered initiative grounded in practice, the capacity under construction with ACCLAIM is *the capacity to consider (in action) the dense happenstance of the rural world as it pertains to teaching and learning mathematics, and the capacity to articulate (especially in works) the meaningfulness and utility of that learning in, for, and by rural people.* The realm of works is a realm in which planning for outcomes might make some difference.

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[2] Not only is school improvement action, schooling itself is action. The proof, on Arendt's terms, is that instruction consists mostly—and necessarily—of *discourse* (speech) among students and teachers.

[3] The conundrum for planners is that improvement of state-sponsored schooling is of course tied to changeable, even fickle, governments.

A framework for works and actions. This essay creates a framework, albeit a professedly tentative one, for such a consideration and for the capacity to articulate that consideration, particularly in those works known as "research". This framework is nonetheless intended to inform, even if slightly, both *actions* (e.g., teaching, professional development action, meetings, conversations, and internal dialogue) and *works* (e.g., student papers, research and evaluation reports, essays, study plans, dissertations) carried on under the ACCLAIM standard.

This framework *can* influence action, but it is not, on the grounds of this essay, advisable to predict that it will or even that it *should* do so. In this sense, the framework, and the essay that embeds it, is more part of a conversation, more like speech, and, hence, more like action. ACCLAIM expects to act on this work (i.e., this essay), reconsidering it and revising it, certainly, but also carrying it forward most visibly into "outcomes": variable works of scholarship.

## Mathematical Knowledge

"Mathematical knowledge" cannot be summarized succinctly or defined in a single way to satisfy even all those who are actively engaged in the generation of new mathematical knowledge. This fact is perhaps all the more surprising since, of all that is taught in school, no knowledge is more definitively structured within the *discipline itself* than mathematics (see Phenix, 1968, on the "structure of disciplines"). Further, within the prevailing regimen of schooling, no subject has been more steadfastly defined in terms of the scope and sequence of instruction than mathematics. Mathematics can be a paragon of national standards because it is comparatively well-structured by its apparent nature as a discipline and school subject. And yet,

the nature of mathematical knowledge is popularly misunderstood, not only by the lay public, but by most of those who teach mathematics in K-12 schools (see, e.g., Hersh, 1997)

Philip Davis and Reuben Hersh (1981) begin their exploration of *the mathematical experience* in this vein:

> What is mathematics? A *naive definition* [emphasis added], adequate for the dictionary and for an initial understanding, is that *mathematics is the science of quantity and space* [original emphasis]. Expanding this [naïve] definition a bit, one might add that mathematics also deals with the symbolism relating to quantity and to space. (p. 6)

Much less naively one might claim that mathematics is about logic—about linking assumptions with conclusions (deductions and inductions) in a rigorous and unfailingly replicable fashion. Or one might claim, pedagogically speaking, that mathematics *ought* principally to concern problem solving. In such ways, there are many alternatives to a "naïve" preoccupation with space and quantity as the fundamental mathematical knowledge.

Contention surrounding definitions turns out to revolve on just the question of *what ought to be*. And the issue of "what ought to be" is very much an educational one, because, in raising children, one is concerned for their capacities not only to realize productive lives for themselves, but for their capacities to sustain and to create a decent world. Does mathematics have anything to do with such concerns for the future of individuals, communities, and the world as a whole?

In a *strictly naive sense*, is it not abundantly clear that the "modern" sciences and technologies that have remade the world (for better and, one must admit, sometimes for worse) since about 1600 have at least been strongly enabled by a continuous stream of methodological

and analogical importations from the realm of "pure mathematics"? Manufacture, mechanization, ground transportation and communication, finance and economics, avionics, electronics, healthcare, government, and entertainment owe tremendous debts to mathematical knowledge (whatever it may be). So do systems of education, in their organization, management, and to some extent in their technologies of improvement—to leave completely aside the mathematical content taught and, in theory, highly valued in schools.

In all this social construction and in with all this application of technologies of everyday life, one may claim that mathematics is a value-free assistant, merely doing what it has been asked to do. This is, in fact, one view of science. If "scientific knowledge" is value-free, so must mathematical knowledge be value-free. Many people believe this to be the case, and on such a view the operation of mathematics outside the discipline proper would be mathematically and, therefore, pedagogically irrelevant.

The difficulty with this position is that science and mathematics are the creations of scientists and mathematicians, and scientists and mathematicians in the contemporary world are most certainly *employees* of institutions and firms whose agendas are decidedly committed, and these commitments are not principally dedicated to the end of creating a better world, even indirectly or tangentially. Indeed, they are not necessarily dedicated to creating better scholarship (or, necessarily, better mathematics).

Moreover, to move gingerly beyond naive considerations, contemporary views of scholarship (in all fields) insist not merely that scholarship *cannot* be value-free, but—more to the point—that passion, imagination, and commitment are the hallmarks of decent scholarship (e.g., Anderson, 1993; Orr, 1995). Albert Einstein, of course, famously remarked that "imagination is more important than knowledge" (in an interview in the *Saturday Evening Post*,

October 26, 1929). Among scholars, this view is therefore rather well established; but to a naive public, it doubtless remains strange and seemingly inconsistent.

Such differences, however, are hardly confined to the realm of scholarly debate. The "math wars"—pitting a view of mathematics knowledge and pedagogy that valorizes concepts and understanding (e.g., Mathematically Sane, 2002; Polya, 1969) against one that valorizes computation and skills (e.g., Allen, 1997; Mathematically Correct, 2002)—revolve around similarly articulated differences in the conception of mathematical knowledge. A key question in the math wars seems to entail something like this: "Is school mathematics *mainly* a set of skills and procedures most useful and necessary to be taught algorithmically for their eventual utility as technical applications in the world of work [a value-free version of mathematical knowledge] or is school mathematics *mainly* a set of intellectual tools useful for thinking, critiquing, and imagining the human condition [a committed version of mathematical knowledge]?"

The American lay and professional public, so far as its views can be judged from the incidence of adoptions of "innovative" curricula (e.g., Lubienski, 2002), adheres stolidly to the former view of mathematical knowledge, the one characterized as "naive" by Davis and Hersh (1981): mathematics is about quantity and space, and therefore, about the skill of manipulating symbols describing quantity and space, useful as technical applications in the world of work, and with little real relevance to the more contentious issues of the human condition.

Within this framework, there is no need for ACCLAIM to place itself on either side of ideological battle lines circumscribed by the word "*mainly*," as used above. It *does*, however, seem to many of those working in ACCLAIM that mathematical knowledge is not *mainly* skills

or *mainly* concepts or *mainly* the purposes to which mathematics is put. It is inevitably all of these things together, perhaps equally.

The landmark *Standards for Curriculum and Evaluation* (NCTM, 1989) put forth an arguably reasonable *compromise* position on mathematical knowledge: in that account, mathematics was described thematically as (1) problem-solving, (2) communication, (3) reasoning, and (4) mathematical connections. This formulation is, and was intended to be, a very *practical* and a very *accessible* representation of mathematical knowledge: sufficiently practical and accessible to be understood, embraced, and acted upon by classroom teachers and school-district leaders acting to improve mathematics education as best they might. It is neither naive nor overly subtle for the intended purposes.

One might adapt the 1989 formulation for the purposes of conceptualizing the cultivation of mathematical knowledge ("mathematics education") within the particularities of context. This essay (and its embedded framework) does not put the following points forward as "standards" of knowledge for school mathematics, nor even as a definition of mathematical knowledge. Suspending disbelief, then, one might claim, with a view to context, that mathematical knowledge encompasses the following sorts of actions:

- reasoning (the necessary inferences, inductions, and deductions arising from assumptions);
- deducing missing elements (i.e., seeing patterns, algebraic thinking, "problem-solving" narrowly construed);
- modeling the real world to understand it, influence, or control it (e.g., geometry, topology, statistics, classical physics);

- manipulating the particular language, symbols, and conventions used by 'mathematicians' (i.e., skill in using mathematical *conventions*); and
- knowing oneself mathematically (accommodating mathematical knowledge).

Certainly these points reflect some of the thinking behind the 1989 NCTM standards, but the reformulation is intended more to suggest the general intellectual applicability of mathematical knowledge to a *wide range* of manifestations in *the lifeworld* so that the *works and actions* sponsored under the ACCLAIM standard *can actually begin to see such a lifeword*—in this case a *rural lifeworld*. Ultimately, many of us involved with the project probably would agree with Cole (1998) that mathematics is "the study of beauty and truth."[4] The phrase certainly is intended to recall the poet's words: all ye know and all ye need to know. It's worth noting that beauty and truth are among the highest standards for a decent life.

Context

With schooling, the word "context" indicates the life circumstances most particularly of students, parents, and community members. Logically enough, however, school professionals are most concerned with context when it figures as a perceived threat to professional accomplishment (see Oakes, 1985). "Context" is thus typically (though by no means always) a marker of presumed deficiency (Howley & Howley, 1999).

[4] A widely unappreciated feature of all intellectual endeavor is its proper concern for "beauty and truth." These qualities may not be "all one need know" (as the poet John Keats claimed), but substantial failure to engage them sharply undermines not the life of the mind and subverts the the quality of the lifeworld generally. This subversion is the problem of instrumentalism generally (see, e.g., Howley, Howley, & Pendarvis, 1995).

Such an account of context may suggest why the most coveted schooling jobs are in affluent suburban communities: in those places, context is more apt to constitute an adjunct to professional accomplishment than a challenge to it. And, with such places, the facilitated success is celebrated as professional excellence and seldom unmasked for what it is: the privileged performance of a social, economic, and political elite. High test scores, strong completion rates, and high aspirations for postsecondary attainment are facilitated outcomes in the suburban enclaves of the largely white, professional, upper-middle-class—otherwise known , and without intended irony, as the education "mainstream."

Operating in such a fashion, schooling quite clearly endows the already-advantaged with additional advantages. This is a familiar process socially; economically, and educationally: the rich get richer and the poor get poorer, sometimes known as Matthew effects after a parable told by Jesus (i.e., Matthew 13:12). The tendency is evident in income distribution in the US since about 1970 (e.g., Bureau of the Census, 2002) and in studies of educational achievement (e.g., Howley & Bickel, 2001; Stanovich, 1986, 1988).[5] The longer the poor attend school, the further they "fall behind" their affluent age-mates. Precisely because mathematics is an eminently teachable subject (Hersh, 1997),[6] Matthew effects could be quite vicious.

From the perspective of the mainstream of the profession, schooling is the ultimate charity for *rescuing students* from deficient lifeworlds. Schooling, in both liberal *and*

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[5] Matthew effects have been *surmised* with respect to the influence of school and district size (e.g., Howley & Bickel, 1999) and *analyzed* for reading achievement (e.g., Stanovich, 1988), but evidently not in mathematics.

[6] According to Hersch (1997), "There's another unrecognized cause of the failure [of mathematics education]: misconception of the nature of mathematics.... A philosophy of mathematics that obscures the teachability of mathematics is unacceptable" (pp. xii, 237).

conservative tellings, is *typically* (though by no means always) something that school professionals wish students to rise above. One rises above context in order to make money and achieve professional status.

What are the problems with this view of *context*? Two problems seem critical.

First, a very persuasive argument has been made (e.g., Valencia, 1997) that *deficit models* of culture(s) come at considerable cost to students' academic views of themselves, precisely because they disparage students' lifeworlds. That is, given a *robustly ascribed* (if no longer exactly *fated*) deficiency, only a select few students will, in the end, rise above their origins. These select few will prove themselves to be more 'resilient' than others; more academically able than others; or, most importantly, more like the (suburban) white, professional, upper-middle-class standard in speech, values, and demeanor. Of course, such students will not merely have "risen above" or "transcended" their origins—they will have distanced, severed, and probably discarded connections with those origins. By contrast with deficiency models, professional educators have been often advised at least to *respect* cultural *differences*, rather than to *condemn* as *deficient* all but an approved, affluent, and white culture.[7] Within mathematics education, of course, some observers assert that considerable blame for failure has long been placed on students, and on students' out-of-school context (e.g., Moses, & Cobb, 2001), whether *deficient* or *different*.

A second criticism, however, can be leveled almost equally at "cultural difference" and "cultural deficit" conceptions: they both avoid most issues of cultural dynamics by representing context as comparatively static. Culture (and therefore "context") is, however, by no means

[7] Cultural difference theory is probably a more common perspective among urban educators (e.g., Trueba & Bartoleme, 1997), special educators (e.g., McGrath, 1999), American Indian educators (e.g., Sheets, 1997), and even mathematics educators (e.g., Mesa, 1998) than among educational policy makers, politicians, or staff of State Education Agencies.

static. Cultures and contexts are continually being remade as time unfolds. The conception of "rural" for instance has undergone a dramatic shift from 1900 to 2000. At the start of the twentieth century, *farming* was a fair description of the rural lifeworld. Many rural residents still engage in household provisioning, but their farming no longer plays the same extensive role in the money economy that it did in 1900. The implications for understanding the meaning of rural life are profound, and hotly debated (e.g., Lyson, 1986; Strange, 1988), but there is no doubt that the change has been culturally momentous, rapid, and possibly disastrous (Berry, 1990; Strange, 1988; Theobald, 1997). If cultures and contexts are subject to rapid change, one must inquire about the causes of change, and one might evaluate the quality of the changes. Are the changes deformations or reformations? Improvements or debasements? Or some of each?

Is there an alternative to the trivialization of culture as deficit or difference? Such an alternative clearly exists, but an appreciation of this alternative requires something of a shift in perspective for educators whether in mathematics education or rural education (see Howley, 1997, 2001 for the extended argument). The alternative perspective requires an exercise of intellect—perhaps another *suspension of disbelief*—such that context be allowed to assume equal importance with the technical concerns of curriculum and instruction. Such a suspension of disbelief makes it possible to appreciate context and schooling as together elaborating a single (if complex, contradictory, and possibly ambiguous) reality.

This view is familiar enough to most scholars in educational foundations and to cognitive psychologists concerned with culture. It is not an extreme position, but one that is nonetheless seldom accommodated in educational practice and more rarely still in policy making, and for quite understandable reasons. Practice tends to concentrate on the enactment of classroom activities and the technical challenges associated with such activity, whereas policy making

typically concerns the challenges of developing and applying uniform procedures within a jurisdiction. In each case, the peculiarities of context tend to be suppressed (not maliciously, but through the focus of immediate professional concern). One might say that the professional context of teaching and of making policy is not kind to context.

Perhaps oddly, educational philosophers (e.g., Bruner, 1996; Dewey, 1916) have insisted for decades that education is nonetheless embedded in culture, and vice versa. Failure to thus privilege culture, according to the cognitive psychologist Jerome Bruner for instance, is to invite not only educational, but cultural, disaster:

> Education *is* risky, for it fuels the sense of possibility: a failure to equip minds with the skills for understanding and feeling and acting in the cultural world is not simply scoring a pedagogical zero. It risks creating alienation, defiance, and practical incompetence. And all of these undermine the viability of a culture. (Bruner, 1996, pp. 42-43)

Culture and education constitute each other; the difficulty, or research challenge, is that "schooling" and "education" are *not* identical (e.g., Dewey, 1916; Goodman, 1964;. Postman, 1995). This recognition—not as common even among educational researchers as one might think—opens a number of hypotheses which a dedicated educator will otherwise find unduly challenging.[8]

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[8] Schooling may attempt to educate, but the success of the attempt has certainly been widely questioned since 1983 (*Nation at Risk*). Everyone alive, however, grows and matures, has experiences, and draws conclusions from such experience (see Dewey, 1916, for such a view of "education"). In this sense, education is *unavoidable*. The contribution of schooling is, however, doubtful—particularly for researchers. In fact when schooling claims itself as the sole or most important educational institution, it exhibits hubris. If the hubris convinces citizens, one might claim they have been misinformed and that this misinformation is the foundation of contemporary miseducation. Many rural people, however, do indeed mistrust schooling *for good reason* (DeYoung, 1995; Silver, 2001).

On such terms, one might, for instance, begin to exercise doubt toward the supposition that schooling is an *inevitably benign* social good. Instead, as the result of contest between the public and private interests of national politics and culture (e.g., Carnoy & Levin, 1985; Giroux, 1983), schooling might well be a *contradictory* social institution, accomplishing some good and some ill simultaneously. Such a possibility might engender a further doubtful question about the balance of good and ill thus enacted. Schooling has even be hypothesized and described *as a largely counterproductive* educational enterprise, with considerable talent (e.g., Gatto, 1990; Goodman, 1964; Illich, 1971).

Whether taken in the *cultural difference* mode, the *contradictory* mode, or the *counterproductive* mode, it is possible to speculate that context may comprise part of students' emancipatory interest (Habermas, 1971) in their own educations.[9] This interest inevitably arises in—but may be amplified (or muted) by—the contexts of students' own lives. The practically interesting possibility, however, is that context be seen to have the *potential* (too often unrealized) to subvert some of the practices of schooling (hypothetically evident to some degree in all schools) that structure lower levels of mathematical accoimplishment for most students in some schools—but most particularly in those schools that enroll children from contexts outside the suburban, white, professional, upper-middle class "mainstream" (see Moses & Cobb, 2001, and Weisman, 1998, for examples).

This is the view of context commended to ACCLAIM scholars for the work of research and for school reform action. The discussion turns, next to an interpretation of rural context

[9] Briefly, Habermas (1971) identifies three human interests: technical, practical, and emancipatory. The interests thus specified concern "information that expands our power of technical control; interpretations that make possible the orientation of action within common traditions; and analysis that free consciousness from its dependence on hypostatized powers" (Habermas, 1971, p. 313). Schooling that systematically deforms, suppresses, or excludes the emancipatory interest would probably be viewed as miseducation by Habermas.

from the perspective of the emancipatory interest.

Rural Context and Cosmopolitan Norms

Rural context is *practically always* regarded as an *impediment*: an impediment to school effectiveness, school excellence, systemic reform, economic development, and global economic dominion, among other educational aims common among policy rhetoric in the United States in the past two decades (Howley & Howley, 1999). This understanding of context, however, characterizes not only mainstream views of schooling (in which learning is cultivated to help students "rise above" deficient cultures or contexts);[10] critical educators, like the educational mainstream, are too quick to regard rural context as *hopelessly* regressive (an understandable result of critical educators' focus on *urban* education; see, for example, Haymes, 1995). As with the mainstream, critical educators' views of rural context too often embrace lazy stereotypes of the rural lifeworld (see Herzog & Pittman, 1995 for an illuminating account of such stereotypes).

Viewed as a natural site of *struggle*, however, *all* contexts are logically apprehended as constituted of contradictory structures and ideologies (a point that critical educators would certainly endorse). Opportunities for both freedom and oppression are embedded in the history, social structure, and culture of rural places—just as they are in all contexts. If rural places are more likely than other places to harbor (or exhibit) anti-democratic forces, the evidence has yet to be presented. Because rural places are much more numerous than large cities, however, they

[10] This discussion does not address the distinction between "rural cultures" and "rural contexts," nor does it address the question of which concept contains the other. Observe, however, that whereas "culture" is a rich concept with numerous competing definitions, "context" is more vague, less well- and oft-defined, and therefore more apt to the purposes of this essay: it refers, in the present usage, mainly to students' "lifeworlds," a concept expounded by Jürgen Habermas (see previous footnote), who contrasts the world of everyday action with the "system world," those massive institutions of modern life that organize and direct human interaction at considerable remove from the realm of everyday action.

do harbor greater variability in the conditions that might be said to characterize them, and this fact means greater variability in the manifestations of justice and injustice (see Duncan, 1999, for compelling examples of such variability).

One might turn, however, to a critical theorist with a rural outlook: Raymond Williams. Williams was a literature professor and cultural critic who taught at Cambridge University, but he has seldom been consulted by educationists (Johnson & Howley, 2001). On the terms of ideological contradiction relevant to rural context, Williams argued that the antithesis of "rural" is not "urban," but "cosmopolitan."[11] His critique, based in part on a reading of the canon of English literature (Williams, 1973) is broadly (rather than narrowly) cultural, and it rests on a description and historical interpretation of the global-metropolitan cultural norms of modernism established after the First World War. According to Williams (1989), although originally the work of avant-garde artists, writers, and other "radical" intellectuals living then as exiles in world-cities, these cosmopolitan norms have been appropriated by trans-national corporate interests, which have sustained them, shorn them of avant-garde critical intent, and propagated and popularized them (Williams, 1989).

These cosmopolitan norms inscribe commitments, behaviors, and understandings that stand in very sharp contrast to rural behaviors, understandings, and commitments: anonymity, isolation, "primitivism," elitism, and violence. These now world-class cultural norms are quite easily apprehended in contemporary mass media, manufactured and purveyed globally from "cosmopolitan centers" (e.g., London, New York, Paris, Los Angeles, Hong Kong, Tokyo). For Williams (1973), one must note, the world-city is *uniquely placeless*. It must be placeless, in his

[11] That is "cosmopolitan" in the sense of the cultural prerogative of world-class cities and the agents of such prerogatives—rather than the typical connotative use of the world to indicate *sophistication*. (See Johnson & Howley, 2001, for an extended interpretation of Williams work for North American educators.)

view, to qualify as a world-city familiar to everyone but actually known by none. Williams' perspective on the placelessness of the world-city is unique, and (in conversation with colleagues) it always evokes the outrage of suburban and urban residents. Williams of course, is not talking about particular city neighborhoods—which certainly do possess identifiable character, but about the world-city as an *ideological formation*.[12]

Conceptions of educational purpose, commitments about schooling, and the actual operation of real schools, are clearly venues, though by no mean the only or most important ones, in which the contest between local senses of reality and the ideological formation "cosmopolitan-*ism*" may be manifested. But because schooling is so clearly tied to a community's (largely tacit) conception of the "common good," schooling offers telling examples of the wider struggle between the local and the global (construed as the cosmopolitan ideological formation).

The critical impulse of a localist, as contrasted with a cosmopolitan, perspective would find transformative possibilities (emancipation) in the life experiences of rural students and families (see Howley & Howley, 1999). In the critical rendering, the rural individual's experience of being different offers a proximate (i.e., "at hand") basis for resistance to entrenched patterns of economic and social domination imposed in part through the privileged norms of the world-city. The rural person, on this view, would find sustenance in his or her cultural identity and use that identity to forge alliances on behalf of a common good, locally fashioned and locally relevant. Such a discussion as the preceding will surely seem tangential to

[12] According to Terry Eagleton (1991, p. 23), "It is possible, then, to think of ideological discourse as a complex network of empirical and normative elements, within which the nature and organizations of the former is ultimately determined by the requirements of the latter." That is, in an "ideological formation" the normative expectations of a powerful (usually dominant) group define the perception of reality for everyone else. A "true education" in some accounts helps students to interrogate such expectations and their contingent perceptions, and perhaps to supercede or transcend them.

many mathematics educators and to most mathematicians. Yet it is profoundly, if prospectively, relevant to the pedagogy of mathematics in rural schools.

Mathematical Knowledge in Rural Context and Vice Versa

Partly on the basis of the foregoing exposition, one might infer two assumptions related to rural context and mathematical knowledge:

- first, that rural context *already* helps constitute the intellects, the identities, and the aspirations of the people it shelters, most particularly of children and youth; and

- second, that rural context *already* contributes to the development of mathematical knowledge in rural children and youth.

The two assumptions purport to *describe* existing reality. More to the point for this essay, however, the putative descriptions harbor a faith that the contributions of context to intellectual development are fundamentally *salutory*. That is, one may suspect that deracinated and il-local lives[13] are intellectually, ethically, and aesthetically impoverished (see, e.g., Berry, 1990). This observation is reflected in a familiar aphorism: to know where you're going, you have to know where you're coming from.

The research base to describe such connections in mathematics education hardly exists; a great deal remains to be discovered about the *contradictory* ways in which the rural context influences the mathematical learning that takes place in rural schools and communities.

[13] "Deracinated" indicates rootlessness and implies a severing of roots (as with exiles); "il-local" is an intentional neologism used to indicate localism gone awry: deformed, debased, deflected or otherwise made dysfunctional, as, in the case of rural context, by cosmopolitan intrusions. In a series of brilliant works, Wendell Berry has developed this viewpoint. The New Work Times has called Berry "the prophet of rural America." For a synopsis of the implications of Berry's work for rural education, see Paul Theobald's short essay, *Rural Philosophy for Education: Wendell Berry's Tradition* (Theobald, 1991).

Typically, those studies that do exhibit a rural connection report that a "rural setting" was the physical location but pose *no* context-related questions, make *no* rural vs. non-rural comparisons, and (naturally enough) draw *no* conclusions related to rural context. Just two dissertations in the past 15 years exhibit research designs that assure substantive rural relevance (see the ACCLAIM Research Initiative web site for further details)—and one of these is written in Chinese.

This research background suggests a third assumption. Unlike the first two assumptions, this one is inherently *prescriptive*:

- that the contributions of rural context to mathematics education should be much better understood *because* such contributions can hypothetically be improved upon for the benefit of rural places.

What does it prescribe?

- a research mission: improvement in understanding the contributions of rural context to mathematics learning and teaching, regardless of what the findings may show, but with very careful attention to the complexities of contradictory local cultures and commitments;
- within such a mission, concern for the balance between the good and ill influences of particular rural contexts, with
- judgments of good and ill based on a broad view of outcomes, particularly those that strengthen rural communities.

The emphasis on benefits to rural communities would appear out of place in most (by no means all, however) of the forums, academic or practical, that consider school improvement in the United States. For the most part, professional educators have trouble embracing the view that communities are legitimate beneficiaries of schooling. Instead, a form of extreme

individualism prevails in which schools (a) exist for the benefit of individual students or for the abstract national economy and (b) insulate themselves from, or become irrelevant to, the local places in which the State has arrogated to itself the authority to place, or to withdraw, them (see Theobald, 1997, for the theoretical argument, and Howley, 1993 for the relevant legal history).

In some rural education forums, however, community focus is much more common than in the educational mainstream (e.g., DeYoung, 1995; Howley & Howley, 1999; Inverness Research Associates, 2001; Kannapel & DeYoung, 2001; Rural School and Community Trust, 1998). For instance, considering school improvement issues in persistently poor, historically oppressed locales such as those served by the Rural Systemic Initiative (RSI) projects of the National Science Foundation (NSF), Inverness Research Associates (2001) observed,

> Viewed from the outside, and compared with other NSF projects, the work done by the RSIs may appear slow or inconsequential. This judgment is, however, incorrect. Only when one truly understands the nature and depth of the challenges facing chronically poor, rural communities it is possible to see that the community development work the RSIs are doing is an essential prerequisite to further mathematics and science reform. (p. iii)

The challenges are indeed immense in such places. But a similar observation can be made about most rural places, even those that are in comparatively comfortable circumstances due to attractive rural amenities (agreeable climate for retirement destinations, lovely scenery that provokes substantial tourism, and so forth). Rural communities, even and perhaps quite strikingly in such places (see DeYoung & Lawrence, 1995, for a culturalist discussion of the conundrums of rural economic development), struggle with questions of self-determination, with

ways to realize their "emancipatory interest" in their commitments and destiny, while simultaneously keeping an eye on business.

Assumptions and contradiction. The three assumptions given here, however, are not static, but are instead embedded in a view of context that honors the concept of "contradictory location," which comes, loosely, from the domain of critical theory. Essential to this concept is the idea of *struggle*, referenced above. The struggle concerns not just the improvement of school mathematics, but (as noted by Inverness Associates, 2001) struggle for more decent lives lived locally. Desired improvement is not guaranteed, and—even with careful thought and planning—cannot be guaranteed or even necessarily predicted, according to the view of action taken as foundational for the purposes of this essay. *Instead, improvement must be wrested from varied influences and interests that are positioned to oppose it.* Some of these opposing interests proceed from local circumstances. Others arise in the world that surrounds rural places and structures many of the options for rural communities (that is, via the normative expectations of the "cosmopolitan ideological formation" and its empirical results; cf. Eagleton, 1991, and Williams, 1989). Still others arise merely from the human condition and are much the same everywhere on earth.

Thus, the assumptions given above are understood by to apply in contradictory fashion: context contributes to intellectual development, but the contribution is an inevitably tense one. For instance, a capable working-class rural student may be tracked into a vocational program because of academically irrelevant considerations; or a not-so-talented middle class rural student may be excused from a service-learning project because service-learning is locally presumed to interfere with academic learning. The vocational student, however, because of the quality of her vocational program, may actually learn mathematics *better* (and perhaps more of it) than the

middle-class student, and yet no one is likely to observe, much less appreciate, these contradictory facts. Several layers of contradiction pervade this entirely hypothetical example—but all the layers (if not their contradictions) would be familiar to those who work in schools, whether rural, suburban, or urban. But "contradiction" is complexity with an edge, and the edginess is what one thinks about the presenting complexities as actors and, to be sure, as thinkers and researchers. Power is at the cutting edge of contradiction—the power to know and the power to act.

In this case, looking beneath the evident surface of what has happened to these two students, one would avoid an easy placement of the onus on, for example, poor counseling. Instead one might seek to understand the social norms and structures that lead a rural student whose family is not oriented to "cosmopolitan norms" to encourage pursuit of a less prestigious schooling despite evident academic talent. And one might well inquire about the role of school culture in this event. Or one could, more closely, question the character of recruitment to advanced mathematics instruction in the rural school. One might ask what unwritten norms and habits govern who is included or excluded; one might study the role of mathematics teachers in rural school cultures; and one might want to understand why and in what ways the mathematics instruction (in this hypothetical case) seems to be better in the vocational than in the academic track.

Contradiction does not embed easy or necessarily *certain* answers to conventional questions. Contradiction may require an analysis of classes' or castes' access to mathematical knowledge; of conflicts between rural and cosmopolitan agendas as they affect mathematics learning and teaching; of the circumstances of economic and community development related to a community's mathematics capacity; or of the position of mathematics within the existential

dilemmas of coming of age in a rural place. Contradiction, in this sense, is an engine for movement ("change" or "struggle"), not a dispute in need of resolution. For the most part, neither practitioners nor members of the public think in such terms. The terms, however, are decidedly appropriate for a research enterprise concerned to approach a complex and largely unknown reality.

Four principles for rural mathematics education research. Four principles reflect the assumptions given above and this essay commends them to ACCLAIM scholars, particularly those involved with research efforts:[14]

1. **Knowledge and Context**. The power, beauty, and truth of mathematics apply to rural settings, even though this application has hardly been described as yet; rural places have power, beauty, and truth, as well, and the relationship of these qualities to mathematical knowledge also lacks any description. Research should describe the salient relationships between mathematical knowledge and rural context.

2. **The Institution of Schooling.** Knowledge of school mathematics serves curiously as a 'gatekeeper' to postsecondary success. Other institutional features of schooling, in like fashion, short-circuit formal educational accomplishment for many rural students. Research should examine rural schools as they serve or subvert such functions.

[14] Each could be easily translated to make them appear relevant to school improvement plans, but the research base for such planning is quite inadequate. What is needed, instead, in school improvement and professional development *action* is a conversational opening about rural context in general, not specific prescriptions for improvement. Judged from the perspective of rigorous research, such prescriptions would be vastly premature.

3. **Community Purpose.** Mathematics learning should not principally constitute a rural export business. The growth of rural students' mathematical knowledge should, on the whole, benefit rural places and rural communities in better balance with benefits to individuals. Research should examine hypotheses about the place occupied by mathematics knowledge in and (prospectively) *for* rural communities.

4. **Curriculum and Pedagogy.** Extant mathematics curriculum and instruction, whether traditional or constructivist, does not articulate *any* substantive connection with rural context. This oversight is hypothetically harmful to the mathematical learning of rural students. Research should elaborate theories of, and knowledge about, "pedagogy of place" for mathematics education in rural schools.

Ultimately one should *not* attempt to ratify such principles empirically. They articulate the motives, aspirations, and commitments of research efforts more respectful of rural context, and not verifiable facts. They articulate a research valence, and on such a view, embed prescriptions about the sorts of questions to ask. They are prospective harbingers of what the mathematics education and rural education research communities might come to know, if considered in their light.

## Conclusion

Apparently the challenge to place mathematical knowledge in context—especially variable and localized rural contexts, and most particularly those rural contexts in which

exploitation figures as a strong historical presence (Inverness Research Associate, 2001)—is so difficult that it has seldom been contemplated. The challenge must, surely, be greatest if one aspires to place "rigorous (and advanced) mathematical content" in rural contexts. Such work has hardly begun anywhere, even among those few people and few organizations devoted to place-based education, community involvement in schooling, and better popular access to knowledge of mathematics.

Few other entities have ever undertaken an extended consideration of the challenges of mathematics education with an orientation similar to that developed in this essay on behalf of ACCLAIM. Several groups have relevant experience and exhibit compatible commitments, but have not described or theorized this domain for mathematics education (see Appendix A, however, for four prominent examples of programs of action).

Indeed, the challenge of such work is probably greater in *conceptual* than in practical terms. Mathematics is a sort of globally comprehensible language (for articulating a particular domain of concepts), possibly a *universal* language. Mathematics has a very distinct, and august, *platonic lineage*: some thinkers—notably including Plato's Socrates—have argued that mathematical objects (ideas, relationships, logical webs) exist quite beyond material reality, in an *ideal* reality that, by its nature, separates such objects from the world of common sense known to ordinary humans. Such knowledge, Plato has Socrates argue in *The Republic*, brings the knower closer to an appreciation of *the world of the ideal*. Many people (albeit a slim minority of humans) find this transcendence intellectually appealing and compelling. The Platonist outlook remains an important locus of the power, truth, and beauty of mathematics. There seems little doubt that most people could use more power, truth, and beauty in their lives.

A Platonist view of mathematics, however, is arguably not dominant, and it meets with

strong competition from formalist and constructivist perspectives (see, e.g., Hersh, 1997). In particular, the utility of mathematics is much more widely appreciated by the general public, especially by the many professions that use practical tools grounded in some fashion on mathematical knowledge.

*Power*, however, is the overlapping quality in the practicality and transcendence of mathematics, and the concept is certainly relevant in both mathematics education and rural education. Rural areas around the globe have long played subservient economic, cultural, and (certainly) intellectual roles to very powerful urban, imperial, and now, cosmopolitan interests (e.g., Jacobs, 1984; Williams, 1989). The rural context is a great deal more than a residential category: it is, instead, a fully and variously realized lifeworld. That lifeworld is contingent on circumstances and commitments that are uncommon and often unknown elsewhere. Surely mathematics—as powerful and intellectual tool as writing and reading (cf. Moses & Cobb, 2001) can help articulate and activate such commitments better than it so far has.

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## Appendix A

### Four Exemplary Programs Relevant to Mathematics in Rural Context

Much has been learned about context by the RSIs; but only one (i.e., the Alaskan Rural Systemic Initiative, AKRSI) concertedly based the whole scope of its efforts on accommodating the strengths of local (literally indigenous) knowledge—almost all of it in science learning. Perhaps a high-level appreciation of the significant *lack* of knowledge about connections between mathematics learning and the influence of rural context now constitutes a legacy of the RSI effort.

The locally-based initiatives loosely associated with one another under the auspices of the Rural School and Community Trust, as well, have devoted years—decades in some cases—of practice to teaching and learning that reflect and absorb issues of place and local sustainability. Some of these groups respond to context with considerable depth compared to the frank absence of place in the cosmopolitan agenda for schooling. Nonetheless, within the Trust itself, mathematics learning and teaching have not been considered *at all* (Lorna Jimerson, personal communication, June 12, 2002). This oversight is not surprising given the challenges elaborated in the present essay.

Family-oriented mathematics programs (Schwartz, 1999) have done work to bridge the gulf between children's school experiences and parental incapacity—or reluctance based on perceived incapacity—to engage mathematical experiences with their children. Program goals understandably focus on enhancing individual accomplishment and lack the dimension of community development cited by Inverness Research Associates (2001). One should note, as well, that the Schwartz synthesis of these programs interprets this literature for urban education,

with particular concern for urban ethnic groups. This interpretation is appropriate, of course, but again illustrates the lack of rural contextualization so common across mathematics education.

In the course of more than 20 years, Robert Moses has articulated a forceful analogy between the civil rights movement and demand for math literacy. The articulation is so forceful that it has opened a new analysis of education, and of the systemic reform of education, that puts social issues in the very center of math education. This is a *remarkable* accomplishment, and is probably seen as applicable mostly to Moses's constituency: African Americans. The Algebra Project nonetheless exhibits many of the commitments and perspectives represented in this essay, in particular its central concern for the quality of the lifeworld.

All of these programs, in fact, demonstrate substantial interest in the connections between academics and the lifeworld. That is, for them as for ACCLAIM, "academics" is not a domain of intellectual activity unmoored from the realities of life, or, much the same thing, from the perceptions and discourses that constitute realities for human beings.

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